

THINGS

of science



HERBS

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HERBS

Many of the varieties of herbs and spices are familiar to you. You have seen them on the grocery shelves, tasted them in your food and noted their fragrance in cosmetics. In this unit we are including seeds of five herb plants so that you can study their growth and characteristics and at the same time enjoy the products of your efforts.

Herbs are plants valued for their flavor and aroma, and still to some extent, their medicinal properties. When the herbs are dried, we call them spices. Spices may be the dried product of almost any part of an herb plant—bark, leaf, seed, root or other part.

The history of herbs and spices goes back to ancient times. Old papyri show that the Egyptians prescribed medicinal herbs around 3000 B.C. and there are written records of medicinal uses of herbs in China around 2700 B.C. You know from your history books about the hazardous trade routes over which spices were brought from the East to the West by caravans in the days of the early Romans and Greeks, and about the great naviga-

tors who in the 15th Century searched for direct sea routes to the spicelands. Today, the once highly expensive and much sought after and coveted spices and herbs are common in most households, and the herb plants native to the East are grown in comparable climates in many regions of the world.

The seeds in your unit are from the plants belonging to two families, the Umbelliferae and Labiatae. Each family has its own characteristics which you will learn to recognize by studying the plants you will grow.

Herbs may be perennial, biennial or annual plants. Perennials are those plants whose roots live from year to year. Their tops may or may not wither back in the winter. Biennial plants grow vegetatively the first year and flower during the second year. After flowering, the roots die. Annuals complete their life cycle in one year and must be reseeded each year. They are usually easy to grow.

Among your seeds there are three annuals, one biennial and one perennial.

First identify your specimens.

ANISE—*Pimpinella anisum*

DILL—*Anethum graveolens*

PARSLEY—*Petroselinum hortense filicinum*

SWEET MARJORAM—*Marjorana hortensis*

SAGE—*Salvia officinalis*

UMBELLIFERAE

(Carrot or Parsley Family)

There are some 3,000 different members in the Umbelliferae family. All of them are herbs with aromatic foliage. They provide us with food, condiments and attractive fragrant flowers. But they also include some very highly poisonous plants.

Among the most poisonous of these is poison hemlock. It was the extract from this plant that Socrates was condemned to drink. All the parts of the herb are poisonous including the root which resembles parsnip. Another lethal Umbellifera is cowbane, whose leaves are sometimes mistaken for celery with fatal results.

Of the seeds in your unit, anise, dill and parsley are of the Umbelliferae family.

Umbelliferae are easy to recognize when in bloom. Their flowers grow in rounded or flattened clusters called umbels from which the name of this family is derived

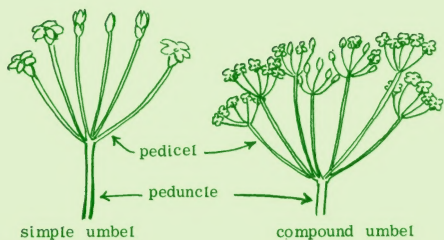


Fig. 1

(Fig. 1).

The flowers in an umbel are on individual stems or pedicels that arise from about the same point from a main axis or peduncle. A cluster of flowers and its flower forming parts, such as an umbel, is known technically as an inflorescence. The pedicels are sometimes called the rays of the umbel. The flowers are small and complete, containing both stamens and pistils, and always fragrant.

Experiment 1. Take a single seed from each of your specimens of anise, dill and parsley so that you may note their similarities and the distinctive features of the seeds of this family.

The fruit of Umbelliferae is called a

schizocarp and is characteristic of the family (Fig. 2). When the schizocarp dries, it splits along the center into two parts called mericarps, each containing a single seed. The dividing line along which the mericarps separate is known as the commissure. Each mericarp is attached to a slender stalk, the carpophore, extending from the pedicel. The mericarp surrounding the seed and the seed coat enclosing the seed itself are so closely fused the whole structure is usually referred to as the seed.

Note the shape of the seeds. They are curved and ovate, one side convex and the other concave. The concave side is the

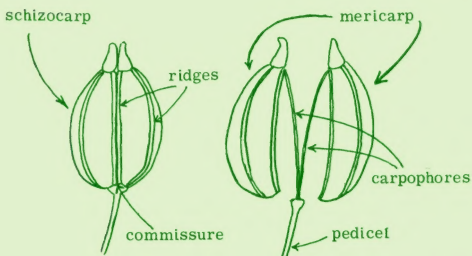


Fig. 2

commissural side.

Look closely at the surface of the seeds. Can you see ridges running along their lengths? A magnifying glass will be helpful here. These ridges are another characteristic of Umbelliferae seeds.

By keeping in mind what you have observed above, you will always be able to recognize the seeds of this family.

Extracts from the seeds of some of the Umbelliferae are still used for medicinal purposes. Dill, for example, is sometimes used as a remedy for colic. The oils of anise and dill are added to dentifrices for flavoring and to medicines to make them more palatable.

Experiment 2. As the plants of this family grow, note the position of the leaves on the stems and the way in which they are attached. The leaves are alternate and their stalks ensheath the stem.

Note the structure of the stems. They are ridged along their lengths in most species of Umbelliferae. Break a stem or two in plants of each of your specimens. Are they hollow? The stems in many species of Umbelliferae are hollow or become hollow when the plant matures or is dried.

PLANTING YOUR SEEDS

To grow your herbs successfully and produce healthy plants, it is important to prepare the bed well and provide good drainage. Spade the ground deeply and lighten the soil with sand and organic matter. Herb plants like soil that is neutral, neither too acid nor too alkaline. If you are not sure of the nature of the soil in your area, ask a neighbor or inquire at your local nursery.

Delay sowing your seeds outdoors until after the last frost. Most seeds will not germinate until the soil warms to 60°F.

When you are ready to sow your seeds, make shallow furrows. Soil may sometimes cake around the seedlings interfering with proper growth. To prevent this, the furrow may be filled with vermiculite. Sprinkle the vermiculite with water and then make another furrow in the vermiculite. Sow the seeds in this furrow. Cover the seeds with a thin layer of vermiculite and water the seeds thoroughly with a gentle mist.

To slow water evaporation, cover the seeded area with newspaper placed about one to two inches above the surface of

the bed. When the seedlings appear, remove the paper.

When the plants develop two true leaves, they are ready to be thinned.

ANISE

(*Pimpinella anisum*)

The anise in your unit is an annual known botanically as *Pimpinella anisum*, a native of the Mediterranean lands and Asia Minor. It is now widely cultivated in most warm climates including India and South America. It is one of the oldest known sources of aromatic seedlike fruits, and has been used since ancient times to flavor foods and for medicinal purposes.

Experiment 3. Smell the anise seeds. Both the leaves and seeds of anise contain the volatile oils responsible for the pleasant aroma of this herb.

Crush an anise seed on absorbent paper. You will obtain a tiny spot of oil. Note the strong aroma produced by just one seed. Does it have a licorice-like odor? The seed contains a hard oily endosperm and many oil tubes within its pericarp or walls. The endosperm is the stored food inside the seed on which the embryo de-

pende for nourishment when it first begins to grow.

Do not eat any of the seeds in your packet. None of the seeds in this unit are meant for eating. But after you have harvested your own seeds, taste a few. Anise seeds have a sweet and very strong licorice-like flavor and it is used today as a substitute for licorice to flavor candies and other confections. True licorice comes from the roots of *Clycyrrhiza glabra*, a plant unrelated to anise.

The taste and fragrance of herbs and their seeds are due to the volatile oils contained in them. Oil extracted from anise is pale yellow and syrupy. Its main constituent is an organic compound anethole. It is this chemical that is responsible for the characteristic smell and taste of anise. Anise oil is widely used in baked goods, soups and cordial liqueurs and is the basis of the French cordial anisette.

Experiment 4. Plant the anise seeds in a sunny location in rows two feet apart and thin to about six inches.

The anise plant is rather slow growing and takes about three months to mature. It is best sown where wanted, but since

it requires a long growing season, in northern areas the plants may be started indoors and then transplanted outside after the danger of frost is over.

The ground should be fertile and light with good drainage. Plant the seeds about one-half inch deep and cover them lightly with the soil or vermiculite, smoothing the surface over.

The best time for planting outdoors for the different areas of the United States are shown below:

North	May-July
Central	April-August
South	March-October
Gulf and Southern California	Anytime

If you start the seeds indoors, transplant them, soil and all, to avoid injuring the roots.

In planting the seeds indoors, you may use peat pots, which can be set out in the garden along with the plants when they are transplanted, or containers, such as a milk carton cut in half lengthwise, filled with vermiculite or with soil low in nutri-

ents.

To prepare a low nutrient soil, mix equal parts of garden soil, sand and sphagnum peat moss.

Fill the container or pots about two-thirds full with the mixture or with vermiculite and dampen thoroughly. Scatter the seeds over the planting medium, lightly covering them with a thin layer of vermiculite. Place a sheet of polyethylene plastic or newspaper over the seeds and keep them in a basement or other location where they can be kept at a temperature between 60° and 75° , and away from direct sunshine. As soon as the seeds have germinated, remove the covering and place the seedlings in a lighted area. Begin watering and fertilizing the plants. Do not place the containers on the window sill. The air is too dry and the temperature too high.

Anise seeds should be kept at temperatures around 70° . They will germinate in about 10 days.

When the danger of frost is over, transplant the seedlings into your garden. Remove them from the container by slicing downward in the soil between the plants.

Lift out each plant with the soil surrounding the roots and place the whole block into a prepared planting hole. If you use peat pots, set the entire pot into the hole. The pot will break down in the soil.

Examine the root of one of your seedlings by carefully pulling it out of the soil. Note that the main or primary root grows straight down from the base of the plant with small roots growing outward laterally from it. This type of root is known as a taproot. Taproots do not take too well to transplanting, so once you have transplanted the anise outdoors, do not attempt to move it again.

The carrot root is a typical example of a taproot.

The anise will grow to about one and one-half feet in height.

Experiment 5. As the anise grows, note the leaves at the base of the plant and those on the flowering stems. Observe how different they are. Those at the base are bright green and about three-fourths of an inch long, rounded and cleft or toothed. Now look at the leaves above. They are not single leaves, like those at the bottom, but compound. They are deeply divided

into featherlike leaflets, three narrow pointed segments to each stalk.

Note that the leaves are petiolate, which means, that they all have stalks attached.

Pick some of the leaves and taste them. Fresh anise leaves may be chopped and added to soups and salads and other foods for flavoring.

Experiment 6. Examine the stems. Are they ridged? Break one. Is it hollow?

Experiment 7. Flowers will appear about three months after planting. Examine the umbels and the individual flowers. Note that the flowers bloom from the outer edges of the umbel first and last at the center. How many petals do the flowers have? Flowers of Umbelliferae are five-petaled.

Experiment 8. After the flowers have matured and as soon the seeds turn grayish, cut off the umbels and spread them out on paper to dry in the shade in a hot airy location. Do not dry them in the sun. A well ventilated attic or garage is ideal.

When the seeds are dry, rub them out of the umbels by hand and separate the chaff by blowing. Store the seeds in a cloth bag to allow plenty of air. Anise

seeds will keep for several years stored in a glass jar at 50°F. In humid areas, store the seeds in tightly covered jars. The seeds must be absolutely dry.

DILL

(*Anethum graveolens*)

Dill is an annual herb of the Umbelliferae family and is indigenous to the Mediterranean area and southern Europe, but is now grown in subtropical and temperate regions all over the world.

It is a tall plant, erect in stem, growing to a height of three or four feet. Its leaves are finely divided and greenish-blue in color and its inflorescence umbels of small yellow flowers.

Dill today is cultivated primarily for use as a condiment, but in early times it was widely used for its medicinal properties and was believed to have magic powers and to be a lucky omen.

Experiment 9. Observe the large oval dill seed closely and you will see three prominent sharp ribs running longitudinally on its convex side. On the outer

edges are two conspicuous winglike ribs that extend outward from the sides, pale yellowish brown in color.

Crush the seed on absorbent paper as you did with the anise seed and note its characteristic odor. Compare it with that of the anise seed.

Dill seeds contain from two to three percent colorless or pale yellow volatile oil. The main constituent of this oil is the organic compound carvone. Carvone is also present in high percentage in the oil of caraway seeds. Dill, therefore, is often substituted for caraway to flavor various foods.

Experiment 10. Dill is easy to grow and its seeds can be planted in any sunny area after the danger of frost is over and the soil temperature is about 60°. It will germinate in about 10 days and mature in six weeks.

Prepare the soil and plant the seeds one-eighth inch deep and at least three feet from the next row. Scatter the seeds thinly in the furrow and cover them lightly with soil or vermiculite so the ground is level again. Thin the seedlings about three inches apart and be sure to weed around

the plants.

The leaves of this plant are put into the brine for pickling, in vinegar to make dill vinegar, or chopped up to provide flavoring to fish, salads and sauces. Dill leaves or dillweed was brewed into a tea by housewives in the olden days to soothe babies with colic.

Experiment 11. Compare the leaves of the dill with those of anise. Observe the features characteristic of the Umbelliferae. Note the similarities in the anise and dill plants.

Pick some of the leaves and note their taste. The dill leaves may be washed and frozen, or if desired, dried.

All parts of the dill are aromatic. Break the stem of one of your plants, and smell it.

Is the stem hollow?

The dill plant is grown for both its foliage and its seed. If you wish to obtain the best dill leaves, they should be cut before the plants flower. If the dill seeds are desired, allow the plants to flower and the seeds to ripen on the plant. Harvest the seeds when they begin to turn yellowish-brown. Dry the seeds in the sun. Store

them in airtight containers.

Dill seeds are used whole or ground as a flavoring for pickling, in breads and to season vegetables.

In order to have a constant supply of fresh dill leaves, seeds may be sown throughout the summer. The last planting date being about September 1 for most areas.

Experiment 12. Examine the dill seeds as you harvest them. Note how the schizocarp separates into two mericarps. Is the carpophore divided?

Experiment 13. If you wish to dry the dill leaves or those of any of the other herbs for later use, spread them out on a wire mesh or gauze, to allow free passage of air, in a shaded protected area at temperatures of less than 100°.

PARSLEY

(Petroselinum hortense filicinum)

Parsley, a native of the Mediterranean, garnished the banquet tables of the ancient Greeks and Romans and flavored their foods as they do ours today. Now as then the herb is grown mainly for its green leaves.

The plant is grown almost everywhere. There are two well-known varieties of parsley, the curly *Petroselinum crispum* and the plain Italian *Petroselinum hortense filicinum*. The seeds in this unit are those of Italian parsley.

This species is readily distinguished from curly parsley by its leaves which are larger and flat and segmented. It also has more flavor than the curly type. Parsley is rich in vitamins C and A and also in iron. However, since it is eaten in only very small amounts, it does not materially benefit us nutritionally.

Parsley is grown primarily for its foliage. Therefore, although it is a biennial plant, it is usually treated as an annual. It is slow to germinate, taking about six weeks to sprout. To get an early start, it may be grown indoors in a warm place, about 75°, in a darkened area. Germination occurs in about 15 days. The parsley can then be transplanted outdoors after the last frost. Or it may be planted outdoors in a protected area in August for use the following spring. In very warm climates, as in the southern states, they may be sown in spring or winter.

Experiment 14. Before planting the

seeds soak them one hour in lukewarm water. Make a furrow one-fourth inch deep at least 16 inches from the next row. Scatter the seeds thinly in the furrow and then cover them with a thin layer of soil and smooth over the ground. Be sure to keep the soil moist and weed carefully around the plants. Thinning is not necessary. Parsley is usually grown crowded in a row.

The plants will grow about a foot tall the first year and then another foot the second year. The leaves may be cut from the growing plant as needed. Cut off any flowering stalks to keep the plants in vegetative growth.

Experiment 15. Note the segmented leaves. Do they have a midrib with smaller veins branching away from it? Such leaves are called pinnate. Compare the leaves of this plant with those of anise and dill. Are they similar?

Experiment 16. Note the taste and odor of the herb. The main constituent of the volatile oil in parsley is apiol, known also as parsley camphor. It is a white crystalline solid having a slight odor of parsley.

Experiment 17. If you wish you may dry the leaves storing them in an airtight container.

Experiment 18. As the plant grows and matures, observe the various parts of the plant and note the features characteristic of Umbelliferae.

Experiment 19. When the summer is over, do not destroy your parsley plants. The following spring you will see new leaves springing from the roots. The plants will bloom during the second year.

What color are the flowers? Is the inflorescence an umbel?

Allow the plant to mature and the fruit to ripen. Collect some of the seeds and note their characteristics.

The fruit of parsley is not used as a spice because the taste is somewhat bitter.

The plants die after flowering. If they are allowed to remain undisturbed in your garden plot, they will self-sow and provide you with a new crop of plants.

Experiment 20. Pull up one of the mature plants and note its roots. How do the roots of the parsley differ from those of the anise and dill?

LABIATAE

(Mint Family)

Almost all members of the Labiatae family to which the sage and sweet marjoram in your unit belong are herbs. These aromatic plants are so distinctive in their appearance and fragrance that they have been known and valued for hundreds of years. There are some 3,000 species of Labiatae distributed throughout the world. Members of the family are found in every continent, but they are more abundant in the Mediterranean.

The plants are important as a source of volatile aromatic oils for flavoring foods and confections, for use in medicines and perfumes as well as for garden ornamentals.

Some of the familiar plants in this family are catnip, thyme, lavender, rosemary and coleus.

Experiment 21. Examine the seeds of sage and sweet marjoram. They are round and hard. Note the difference in their sizes. Four of these nut-like seeds are contained in each fruit and released when the fruit breaks on ripening.

Experiment 22. As your plants grow, notice the position of the leaves. They are opposite or whorled rather than alternate as in Umbelliferae.

Experiment 23. Note the stems. Are they square (quadrangular)? Most Labiatae have square stems.

Experiment 24. Observe the way in which the leaves grow from the stems. Note that the leaves are without stems where they attach to the main axis.

Compare the leaves of the Labiatae with those of Umbelliferae.

Experiment 25. Examine the roots. Are they different from those of Umbelliferae?

Experiment 26. When the plants begin to flower, note their position. They are usually located at the upper part of the plant growing from between the leaf and stem. The inflorescence is a cyme (Fig. 3). A cyme is a flat topped cluster composed of a few flowers in which the central flowers open slightly before the outer ones. Cymes usually occur in plants with opposite leaves.

Note the shape of the flowers. They are two-lipped and somewhat tubular in



cyme

Fig. 3

shape. The name Labiatae meaning lipped comes from this characteristic structure of the flower.

The oils that give the flowers their appealing fragrance are found in the glands of the calyx as well as in the petals or corolla.

The calyx, consisting of leaflike sepals, is the outermost part of the flower.

SWEET MARJORAM

(Marjorana hortensis)

Sweet marjoram, an annual indigenous to the Mediterranean, was well-known to the Greeks and Romans and widely used for medical purposes, and as a flavoring

for various foods and wines. It was also considered a symbol of happiness and a charm against witchcraft.

Experiment 27. The seeds of sweet marjoram take about two weeks to germinate. Since they take so long to sprout, you may wish to plant them indoors and then transplant them in your garden when the weather is warmer. During germination the seeds should be kept moist and at about 70°. They will then germinate in about 8 days.

When sowing the seeds be careful to scatter them sufficiently or the tiny seeds may fall too close together.

After transplanting them in a sunny spot in properly prepared soil keep the plants shaded until growth is established. Cultivate around the plants keeping them free of weeds. The plants grow slowly and need constant care.

Marjoram grows to a height of about eight to 12 inches.

Experiment 28. This herb is a bushy plant with small gray-green leaves with rounded ends. Feel the surface of the leaves. Note the smooth velvety texture.

Are the leaves opposite each other?

Experiment 29. As the plant matures, watch for the flowers and see if they grow where you expect them to. They grow in clusters between the leaves and the stem. What color are the flowers? Are they two-lipped?

Experiment 30. Smell the leaves and taste them. Sweet marjoram is closely related to oregano and is used in similar ways.

If you have some oregano handy taste it and compare its taste with that of the marjoram.

Since ancient times both marjoram and oregano have been used as stimulants, tonics and for a variety of ailments such as rheumatism, coughs and insect bites.

Today, however, marjoram is used only as an herb for flavoring foods and garnishing them.

Experiment 31. The leaves of marjoram are dried and stored either whole or ground.

If you wish to dry your plants, the leaves should be collected when they are about half grown or just when the first buds of flowers appear, usually in midsummer. The plants may be cut two to three inches

from the ground. Since the plant is low growing, it should be washed well and carefully cleaned before drying.

The oil is extracted from the plant by steam distillation. The volatile oil of sweet marjoram is greenish-yellow and contains some 40% of the organic chemicals known as terpenes. Not much is known about the chemistry of this oil, but there are two compounds present in significant amounts. One is terpinene with a lemonlike odor and the other terpineol which smells of lilacs. The two are believed to contribute most of the fragrance to this plant.

The seeds of marjoram which contain little aromatic oil are not used as a spice.

SAGE

(Salvia officinalis)

The sage, *Salvia officinalis*, is a tall hardy perennial plant that grows to a height of 2½ feet, and like the other herbs in this unit, is a native of the Mediterranean region.

It was believed to have healing powers in the times of the Greeks and Romans and was used more as a medicinal herb than as a condiment during that era. It

was said to cure a diversity of maladies from the common cold to palsy. The name *Salvia* is derived from the Latin word *salvere* meaning to save.

The use of sage as a condiment became more and more popular during more recent times and is now commonly used to flavor meats, poultry stuffing, and many other foods.

Experiment 32. Crush one of your sage seeds on absorbent paper. Does it leave an oil spot? Is there a strong aroma of sage from the seed? The seeds of Labiatae do not store the volatile oils as do those of Umbelliferae. Thus, no oil spot appeared, nor was there a significant fragrance emanating from the crushed seed.

Experiment 33. Sage is fairly easy to grow and matures very quickly so it may be planted directly outdoors in the garden early in spring once the danger of frost is over. Choose a sunny piece of ground. Make a furrow $\frac{1}{8}$ -inch deep at least two feet from the next row. Scatter the seeds thinly in the furrow and cover them so the ground is level again. Thin the plants one foot apart.

Experiment 34. As the plant develops,

note its erect stem. Its foliage is thick and much branched. Note that the leaves are green when young, but turn a grayish color as they grow older. Are the leaves alternate or opposite? (Note drawing of part of a sage plant on front cover.)

Feel the surface of the leaves. Compare the leaves of sage with those of marjoram. Look at the stems. What is their structure?

Check the plant for other characteristic features of the Labiatae family.

If you plan to dry the leaves, pick them when they are half grown. The young leaves may be chopped up to flavor various foods.

Experiment 35. Allow one or two of your plants to flower and seed.

Where do the flowers form? Is the inflorescence a cyme? The large blue flowers are showy and fragrant and their nectar attracts the honeybees.

Are the flowers two-lipped? The flowers of Labiatae are designed to help the bee pollinate the plant. As the honeybee alights on the broad lower lip of the flower and enters the tube-like corolla to reach the nectar, it trips the stamen nestled in the lobe above. A shower of pollen falls on

the bee's fuzzy back. The pollen is given up to the pistil of another flower when the bee goes inside it looking for more nectar.

The pleasant flavor of sage and its characteristic strong odor is due to thujone, the chief constituent of the volatile oil contained in this plant.

Crush some of the leaves. Note the strong odor of sage.

The subject of herbs is a popular one and many books have been written about them. If you wish to look further into this fascinating lore, you will probably find many references in your local library.

However, we are listing a few which should be helpful.

The Book of Spices, by Frederic Rosengarten, Jr., Livingston Publishing Co., Wynnewood, Pa.

Growing Flowering Annuals, Home and Garden Bulletin No. 91, U. S. Dept. of Agriculture, Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. (10¢)

Growing Flowering Perennials, Home and Garden Bulletin No. 114, U.S.D.A., Supt. of Documents, U.S. Government Printing Office, Washington, D.C. (15¢)

Herbs for Every Garden, by Gertrude B. Foster, E. P. Dutton & Co.

Spices, by John W. Parry, Chemical Publishing Co., Inc., New York.

Taxonomy of Vascular Plants, by George H. M. Lawrence, Macmillan Company, New York.

Textbook of Systematic Botany, by Deane B. Swingle, McGraw-Hill Book Co., New York.

This unit was prepared with the cooperation of the Asgrow Mandeville Company, Cambridge, New York.

Appreciation is expressed to Dr. H. M. Cathey, Ornamental Investigations, Plant Industry Station, U. S. Department of Agriculture, Beltsville, Maryland, for reviewing this booklet.

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